The impact of tariffs and PTAs on trade flows and the wage gap*

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October 10, 2013

In this paper we develop a three-country model with variable elasticity of substitution and vertical linkages to study the impact of bilateral tariff reductions and preferential trade agreements (PTAs) on trade creation, trade diversion and labor market outcomes. Focusing on the short run, our model predicts that bilateral tariff reductions and PTAs increase trade flows between the involved countries, diverting it away from third countries because of tougher competition within the integrating markets. It also predicts that unskilled employment may decrease due to layoffs on the domestic lines of production and the wage gap between skilled and unskilled workers increase. We test the model's predictions and its welfare implications using two complementary datasets: the first on bilateral trade flows, covering 186 countries from 1989 to 2007; the second on wage and employment levels by level education for OECD countries from 1970 to 2005. Our empirical analysis provides results in line with the predictions and suggest that vertical linkages may be an important element to understand the impact of PTAs on trade flows and labor markets.

JEL codes: F12 - F16 - J31

Keywords: PTAs - Vertical linkages - Trade diversion - Trade creation - Wage gap.

*The views expressed are purely those of the authors and may not under any circumstances be regarded as stating an official position of the institutions they are affiliated to.

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1 Introduction

After the substantial failure to find an agreement in the multilateral round of trade negotiations started in 2001 in Doha, the EU and most developed countries are currently aiming at signing bilateral Preferential Trade Agreements (PTAs) with individual trade partners. In addition, even during global trade talks, the number of PTAs in the world has kept on increasing, from the 70 PTAs that were in force in 1990 to almost 300 in 2010 (World Trade Report, 2011). Building on a traditional strand of literature dating back to Viner (1950), in this paper we develop a framework to investigate theoretically and empirically what are the likely trade and labor market impacts of PTAs and, more generally, of a bilateral reduction in trade barriers on the countries involved and on third countries.

Our main contribution is the introduction of vertical linkages in a three-country international trade framework with monopolistic competition and two types of workers, skilled and unskilled, to investigate the impact of bilateral PTAs and tariff reductions on trade flows, employment levels, the wage gap and welfare. Introducing vertical linkages allows us to capture the idea that the availability of cheaper intermediates due to PTAs and bilateral tariff reductions may allow firms to reduce production costs. Trade liberalization may thus not only affect trade flows, but also alter employment levels, the wage gap between skilled and unskilled workers and, consequently, local and global welfare levels.

As for trade flows, we analyze the effects of bilateral trade liberalization processes on trade creation and diversion. The issue has already been analyzed empirically (see, for example, Trefler, 2004; Clausing, 2001; Baier and Bergstrand 2007; Head and Mayer 2013) and theoretically, in the context of a model with love for variety (Romalis, 2007), but not yet including vertical linkages and variable elasticity of substitution. Even though trade in intermediate inputs has often been neglected (with the notable exception of Amiti and Konings, 2007), it is known by now that it represents 56% of overall trade flows in goods and 73% of services (Miroudot, Lanz and Ragoussis, 2009). Hence we include it as one of the key elements of our model, notably by allowing firms to save on their fixed costs. The give some intuition on the underlying mechanism, imagine an

entrepreneur who has to decide whether to develop her own computer softwares or buying them on the market. A reduction in trade barriers would make the latter alternative relatively cheaper and expand the "savings frontier" of the entrepreneur, engendering a higher level of profits.

However, it should be noticed that a reduction in production costs does not necessarily imply changes in the pricing strategy or an improvement in export competitiveness vis-à-vis third countries if, for instance, intermediate inputs are substitutes of physical capital. This drive us to adopt the specific structure of the theoretical model that will be presented below and to verify if its predictions are compatible with the data.

Specifically, we use a quadratic utility framework in which firms based in three countries produce goods that can be used for final consumption or as intermediates in the productive process to reduce the fixed costs of setting up a firm. In particular, we follow Picard and Tabuchi (2013) that assume, as in Krugman and Venables (1995), that firms and consumers use the same set of differentiated goods.[1] Firms can sell their products domestically or export them to other countries facing iceberg trade costs, which are assumed to be altered as a consequence of bilateral tariff reductions or of PTAs. In this framework we show that bilateral trade liberalization is expected to increase trade flows between the countries involved, but divert trade away from the countries excluded, which export less to the integrating countries because of their tougher competitive environment.[2] Notice that our framework is different from a New Economic Geography model with vertical linkages à la Krugman and Venables (1995) because, for the sake of tractability, we focus on the short run and thus assume that the number of firms in each country is fixed and proportional to the number of its skilled workers (i.e., it is not determined endogenously by the interplay of agglomeration and dispersion forces or by the reduction in fixed costs of entry due to cheaper intermediate goods).[3]

[1] Let us recall that Krugman and Venables (1995) use a framework in which firms face a Cobb-Douglas composite requirement of labor and intermediates (which are aggregated with constant elasticity of substitution). Instead, Picard and Tabuchi (2013) extend the endogenous mark-ups setup with the linear demand system developed by Ottaviano, Tabuchi and Thisse (2002) to explain the location within a city of firms that produce without variable inputs making use of three different fixed inputs: labor, physical capital equipment and intermediate goods or services.

[2] Notice that in the context of an imperfect competition model, the concept of trade diversion has to be slightly adapted from the traditional definition of a shift of production from a lower-cost nonmember source to a higher-cost member source (Viner, 1950). As remarked by Bhagwati, Krishna and Panagariya (1999), "a more general definition of trade diversion would not involve identical products, and it would not require any paticular differences in costs" but it would rather reflect a distortion of price signals that incorrectly reflect costs and affect consumption patterns.

[3] Starting from the seminal work by Venables (1996), the New Economic Geography literature has shown that intermediates and vertical linkages among firms play a relevant role in determining the space distribution of firms.

Turning to the labor market outcomes, a reduction in trade barriers is expected to increase unskilled workers' employment in the lines of production serving the export segments and to reduce it on the domestic segment. The overall impact on production and employment of unskilled workers is not a priori determined and depends on the parameters of the model, notably on the relative importance of barriers to entry and differentiation between varieties. However, empirically we find that total unskilled employment is likely to fall as a result of trade liberalization. As for skilled workers' remuneration and the wage gap between skilled and unskilled workers, our simulations predict that they are expected to grow.

Furthermore, since a PTA or a reduction in bilateral tariffs is expected to lower imported goods' prices and to increase skilled workers' wages, consumers in the integrating regions experience improvements in their welfare that are likely to exceed the welfare losses incurred by the countries excluded, whose only source of loss is the shift in income towards the integrating countries due to trade diversion. This confirms that even bilateral trade liberalization is locally beneficial improving and is likely to be globally welfare improving.

This paper adds to the existing empirical literature on the labor market effect of trade liberalization by moving beyond the single country analysis to a panel including developed and developing countries through the last three decades. Indeed, to the best of our knowledge, existing literature focuses only on single country studies to assess the labor market effect of trade liberalization (see Goldberg and Pavnik 2005; Gonzaga, Filho and Terra 2006; Amiti and Davis 2011; Amiti and Cameron 2012). Here we explore the cross-country (and time) variation of trade liberalization episodes to derive arguably more general conclusions on the empirical link between trade and labor market outcomes.

Specifically, we test the theoretical predictions of our model on trade using highly disaggregated bilateral trade flows data from BACI for a set of 186 exporting and importing countries from 1989 to 2010. As for labor statistics, we use EU KLEMS data on wage and employment level by education attainment for a sample of OECD countries in the period 1970-2005.

In line with our expectations, we find that reductions in trade barriers (in general) and tariffs (in particular) are associated with trade creation between the countries involved. We also find trade

diversion effect only when the importer country signs a PTA with a third country (no evidence of trade diversion when the exporter country signs a PTA with a third country). The wage gap does increase as a consequence of greater trade openness (measured as a decrease in average trade barriers vis-à-vis the rest of the world) and the employment of unskilled workers employed to serve the domestic market decreases.

The remainder of the paper is organized as follows. Section 2 introduces the theoretical model and derives short run equilibrium results to be tested. In section 3 we describe our empirical strategy to test the model; in particular the trade related tariffs' and PTAs' effects (section 3.1.1) and the labor market related effects (section 3.2.2). In section 4 we show econometric results. Section 5 concludes.

2 The model

We consider a world which consists of three countries indexed with $r = i, j, z$, each populated by L_r identical unskilled workers supplying labor services to a competitive industry producing a homogeneous good and to a monopolistically competitive industry producing a variety s of a horizontally differentiated good. In addition, in each economy there are H_r identical skilled workers supplying labor services only to the monopolistically competitive industry. Specifically, each differentiated variety s is associated with a constant marginal cost of production equal to the wage of c_s unskilled workers. To start production, firms are assumed to face three types of fixed costs, which are given by the requirement to employ, respectively, physical capital equipment, intermediate goods and skilled labor. All the producers in the monopolistic sector employ the same technology and are thus homogeneous in their marginal cost of production. Finally, the three economies are assumed to be symmetric both in consumer preferences and in the production technologies of the two sectors, but they may vary in the size of their populations and in the degree of bilateral integration. We turn now to the description of the demand and supply side that, for ease of exposition, will be presented without referring to the location of consumers and producers.

2.1 The demand side

The preferences of each individual ζ are represented by the following quadratic utility function à la Ottaviano, Tabuchi and Thisse (2002):

$$U(q_0^\zeta; q_s^\zeta, s \in N) = q_0^\zeta + \alpha \int_{s \in N} q_s^\zeta ds - \frac{1}{2}\beta \int_{s \in N} (q_s^\zeta)^2 ds - \frac{1}{2}\gamma \left(\int_{s \in N} q_s^\zeta ds \right)^2 \tag{1}$$

where q_s^ζ is individual ζ's consumption of variety $s \in N$ of the differentiated good and q_0^ζ is its consumption of the homogeneous good which is chosen as the numéraire of the model; α, β and γ are positive preference parameters. Specifically: α represents the intensity of preferences for the differentiated good relative to the homogeneous good; β represents the degree of consumers' bias towards product differentiation; and γ represents the degree of substitutability between each pair of varieties. The budget constraint of an individual ζ is

$$\int_{s \in N} p_s q_s^\zeta ds + q_0^\zeta = w^\zeta + \bar{q}_0^\zeta \tag{2}$$

where p_s is the price of variety s, w^ζ is the individual's income and $\bar{q}_0^\zeta$ is his/her initial endowment of the numéraire, which is assumed to be sufficiently large to ensure that consumers have positive demands for the numéraire in equilibrium.

Maximization of (1) subject to (2) yields the following representative consumer ζ demand function:

$$q_s^\zeta = \frac{\alpha}{(\beta + \gamma N)} - \frac{1}{\beta} p_s + \frac{\gamma}{\beta (\beta + \gamma N)} P \tag{3}$$

where N is the measure of consumed varieties (that are also used by firms as intermediates) with average price $\bar{p} = \frac{1}{N} \int_{s \in S} p_s ds$, and the price index $P = N\bar{p}$.

2.2 The supply side

In the competitive sector, one unit of the homogeneous good is produced with one unit of unskilled labor. Since the homogeneous good is assumed to be freely traded, we use this good as the numéraire and this implies that the unit wage of unskilled workers is equal to one in all countries.

In the monopolistic sector, a firm producing variety s employs c_s units of unskilled labor at the prevailing unskilled labor wage to produce one unit of the good and it incurs in a fixed cost of production that consists of three inputs: physical capital equipment, intermediate goods (and services) and skilled labor. Specifically, each firm needs h units of skilled labor (with wage w_h) and the capital acquired by the firm costs K units of the numéraire. Alternatively, as in Picard and Tabuchi (2013), each firm of type s can acquire $q^\iota(.)$ units of all intermediate goods at a price $p(.)$ to reduce its cost of physical capital or operation: thus, physical capital and intermediate goods are input substitutes.[4] One interpretation is that a part of the physical capital can be replicated by a set of intermediate inputs at a lower cost. More specifically, the use of a set of all intermediate inputs $q^\iota(.)$ (available in the country where the firm is producing) reduces the requirement for physical capital to $K - C(.)$ units of numéraire, where for the sake of tractability $C(.)$ is modeled employing the same functional form as the composite good in the consumers' preferences, that is

$$C(q_x^\iota, x \in N) = \alpha \int_{x\in N} q_x^\iota dx - \frac{1}{2}\beta \int_{x\in N} (q_x^\iota)^2 dx - \frac{1}{2}\gamma \left(\int_{x\in N} q_x^\iota dx \right)^2 \tag{4}$$

and the total cost of intermediates is given by $\int_{x\in S} p_x q_x^\iota dx$. Notice that this cost of intermediates and the expression for $C(.)$ in (4) are common to all firms in the monopolistic sector. Finally, since each firm has to employ h units of skilled workers, fixed costs are given by the following expression

$$f = K - C(.) + \int_{x\in N} p_x q_x^\iota dx \; + h w_H$$

where w_H is the unit wage paid to skilled workers.

[4]Let us notice that in our paper both the parameters m and k, which denote the input-output multipliers in Picard and Tabuchi (2013), are set equal to 1.

As in Picard and Tabuchi (2013), each firm has to set the price p_s for its variety and to determine its demand of intermediate inputs $q^{\iota}(.)$ produced by other firms. Since the former decision affects operating profits and the latter fixed costs, the two decisions can be disentangled into the maximization of operating profits and the minimization of fixed costs. Given that firm's cost minimization has the same form as the consumer's utility maximization, it entails that the intermediate demand for variety x of each firm has the same form as (3) and it is given by

$$q_x^{\iota} = \frac{\alpha}{(\beta + \gamma N)} - \frac{1}{\beta} p_x + \frac{\gamma}{\beta (\beta + \gamma N)} P \tag{5}$$

Following Picard and Tabuchi (2013), the minimized fixed cost is then given by

$$F = K - S[p(.)] + hw^H \tag{6}$$

where w^H is the unit wage of skilled workers and $S[p(.)]$ are the cost savings due to the use of intermediates and they are given by

$$\begin{aligned} S[p(.)] &= \frac{\alpha^2}{2(\beta + N\gamma)} N - \frac{\alpha}{\beta + N\gamma} \int_{x \in N} p_x dx + \\ &\quad - \frac{\gamma}{2\beta (\beta + N\gamma)} \left[\int_{x \in N} p_x dx \right]^2 + \frac{1}{2\beta} \int_{x \in S} (p_x)^2 dx \end{aligned} \tag{7}$$

2.3 Market outcomes

Each firm s located in country $r = i, j, z$ produces for market $v = i, j, z$ the quantity that satisfies both the demand of consumers and of firms located in v, that is

$$q_{s,rv} = q_{s,rv}^{\zeta} (L_v + H_v) + q_{s,rv}^{\iota} M_v \tag{8}$$

where $q_{s,rv}^{\zeta}$ and $q_{s,rv}^{\iota}$ respectively denote the demand by consumers and firms located in country v for the production of firm s located in country r, and M_v represents the number of firms producing

in v. Moreover, given that h units of skilled workers are employed as a fixed input to produce each variety and since we assume that there is full employment of all workers, the number of firms in country v is

$$M_v = \frac{H_v}{h}$$

This implies that the price index of differentiated goods in country v is

$$P_v = \int_{x \in N_v} p_{x,rv} dx = \frac{H_i}{h} p_{iv} + \frac{H_j}{h} p_{jv} + \frac{H_z}{h} p_{zv} \tag{9}$$

Finally, given that all firms sell in all markets, the number of varieties used as intermediates by firms and consumed by workers is equal in all countries and given by $N_v = M_i + M_j + M_z = N$ with

$$N = \frac{H_i + H_j + H_z}{h}$$

Operating profits of a representative firm which produces in r are obtained by adding operating profits which derive from sales in all the three countries. Specifically, operating profits obtained by a firm s producing in r from its sales in country v are given by

$$\pi_{s,rv} = \left[p_{s,rv} - \tau_{rv} c_s \right] q_{s,rv} \tag{10}$$

where $\tau_{rv} > 1$ represents the role of iceberg trade costs: each firm producing in r has to send τ_{rv} units of its production from r in order to have one unit sold in v; $\tau_{rv} = 1$ when $r = v$, that is there are no internal trade costs within a country. We also assume that $\tau_{rv} = \tau_{vr}$. Hence, markets are segmented and each firm can sell its product at different prices in different markets.

Then, making use of (10) and (6), pure profits π_r of firm s which produces in country r are

$$\pi_{s,r} = \pi_{s,ri} + \pi_{s,rj} + \pi_{s,rz} - F_{s,r} \tag{11}$$

where minimized fixed costs in r, $F_{s,r}$, can differ across the three countries for firms having the same marginal cost c_s because of differences in: (i) the wage of skilled workers w_r^H; and (ii) the

price of intermediates goods used in r (which is clearly equal to the price of consumption goods available in r), that is $P_r = \int\limits_{x \in N_r} p_{x,vr} dx$.

In the long run, firms earn zero profits and this implies that using (11), the unit wage paid by each firm s at location r to skilled workers should be equal to

$$w_r^H = \frac{\pi_{ri} + \pi_{rj} + \pi_{rz} - K + S[N_r, P_r]}{h} \tag{12}$$

Markets are segmented and each firm s producing in r sets its price for market v by

$$max_{p_{s,rv}} \ \pi_{s,rv} = [p_{s,rv} - \tau_{rv} c_s] \, q_{s,rv}$$

subject to its demand function in v

$$q_{s,rv} = \left(\frac{\alpha}{(\beta + \gamma N_v)} - \frac{1}{\beta} p_{s,rv} + \frac{\gamma}{\beta \, (\beta + \gamma N_v)} P_v \right) (L_v + H_v + M_v)$$

obtained substituting (3) and (5) into (8). Thus, the price set in market v by firm s producing in r is

$$p_{s,rv} = \frac{1}{2} \tau_{rv} c_s + \frac{\alpha\beta + \gamma P_v}{2 \, (\beta + \gamma N_v)} \tag{13}$$

Furthermore the profit maximizing price $p_{s,rv}$ and output level $q_{s,rv}$ of a firm with cost c_s satisfy

$$q_{s,rv} = \frac{(L_v + H_v + M_v)}{\beta} \left[p_{s,rv} - \tau_{rv} c_s \right] \tag{14}$$

and maximized profits are

$$\pi_{s,rv} = \frac{(L_v + H_v + M_v)}{\beta} \left[p_{s,rv} - \tau_{rv} c_s \right]^2 \tag{15}$$

We can substitute prices from (13) in (9) together with the assumption that c_s and N are common to all countries to get

$$P_v = \frac{N \frac{\alpha\beta}{2(\beta + \gamma N)} + \frac{1}{2} \delta_v c_s}{1 - \frac{\gamma N}{2(\beta + \gamma N)}} \tag{16}$$

where $\delta_v = M_i\tau_{iv} + M_j\tau_{jv} + M_z\tau_{zv} = \frac{H_i}{h}\tau_{iv} + \frac{H_j}{h}\tau_{jv} + \frac{H_z}{h}\tau_{zv}$.

Making use of (14), (13) and (16), we get that local sales of a firm producing in i are

$$q_{s,ii} = \frac{L_i + H_i + M_i}{\beta}\left[\alpha\frac{\beta}{2\beta+\gamma N} + \frac{1}{2}\gamma c_s\frac{H_j\tau_{ji} + H_z\tau_{zi}}{(2\beta+\gamma N)\,h} - \mu_{ii}\frac{1}{2}c_s\right] \tag{17}$$

where $0 < \mu_{ii} = 1 - \frac{\gamma H_i}{h(2\beta+\gamma N_i)} = 1 - \frac{\gamma M_i}{(2\beta+\gamma N_i)} < 1$, while its exports in country j are

$$q_{s,ij} = \frac{L_j + H_j + M_j}{\beta}\left[\alpha\frac{\beta}{2\beta+\gamma N} + \frac{1}{2}\gamma c_s\frac{H_j + H_z\tau_{zj}}{(2\beta+\gamma N)\,h} - \mu_{ij}\frac{\tau_{ij}}{2}c_s\right] \tag{18}$$

with $0 < \mu_{ij} = 1 - \frac{\gamma\frac{H_i}{h}}{2\beta+\gamma N_j} < 1$ as $\frac{H_i}{h} = M_i < N_j$. Moreover, from expression (18) we get that exports to country z of a firm producing in i are

$$q_{s,iz} = \frac{L_z + H_z + M_z}{\beta}\left[\alpha\frac{\beta}{2\beta+\gamma N} + \frac{1}{2}\gamma c_s\frac{H_z + H_j\tau_{jz}}{(2\beta+\gamma N)\,h} - \mu_{iz}\frac{\tau_{iz}}{2}c_s\right]$$

where $0 < \mu_{iz} = 1 - \frac{\gamma H_i}{h(2\beta+\gamma N_z)} < 1$. Thus, it is readily verifiable from (18) that the quantities exported by firms in i towards j , $q_{s,ij}$, increase if τ_{ij} decreases and decrease if τ_{jz} decreases, while they are not affected by a reduction in τ_{iz} . This observation entails the following empirically testable propositions:

Proposition 1 (trade creation): a decrease in trade barriers between country i and j is expected to increase their bilateral trade flows;

Proposition 2 (no improvement in export competitiveness): a decrease in trade barriers between country i and j is not expected to increase the exports of i to a third country, z;

Proposition 3 (trade diversion): a decrease in trade barriers between country j and a third country, z, is expected to decrease the exports of i to j.

At first sight, the second and the third propositions may appear counterintuitive and specific of the model under consideration. Yet, they just stem from two rather simple and common assumptions: market segmentation and pricing-to-market behavior. The former assumption is widely

documented in the literature (Engel and Rogers, 2001; Görg, Halpern and Muraközy, 2010) and warrants that changes in market aggregates in one country do not spill over directly to other markets in the short run (they may only in the long run, due to the overall reallocation of productive resources in the economies). The latter assumption derives from the consideration that firms always charge the profit-maximizing prices in the markets where they ship their products and ensures that no changes are expected in quantities or prices of shipments to market z if non changes are observed in its market aggregates. The combination of these two assumptions then explains why, after all, *Proposition 2* and *3* are in line with our a priori expectations of the model.

Turning to the labor market outcomes, one additional proposition may be derived from the previous equations. Noting that unskilled workers are employed proportionally to the quantities produced, it can be noted from (17) and (18) that the number of unskilled workers employed in country i decreases on the domestic segment and increases in the export segment if trade barriers decrease. Even if the overall effect depends on the values of the parameters of the model, the following propositions can be tested on the total employment:

Proposition 4 (employment loss on the domestic segment): a decrease in the trade barriers faced by country i is expected to decrease the employment levels of unskilled workers producing in i for the domestic market.

In other words, once the level of exports is controlled for, a decrease in trade barriers is expected to decrease the employment level of unskilled workers.

Making use of (13), (15) and (16), maximized profits of a firm producing in i from local sales and exports in country j and z are respectively given by

$$\pi_{s,ii} = \frac{(L_i + H_i + M_i)}{\beta}\left[\alpha\frac{\beta}{2\beta+\gamma N} + \frac{1}{2}\gamma c_s\frac{H_j\tau_{ji} + H_z\tau_{zi}}{(2\beta+\gamma N)\,h} - \mu_{ii}\frac{1}{2}c_s\right]^2; \tag{19}$$

$$\pi_{s,ij} = \frac{(L_j + H_j + M_j)}{\beta}\left[\alpha\frac{\beta}{2\beta+\gamma N} + \frac{1}{2}\gamma c_s\frac{H_j + H_z\tau_{zj}}{(2\beta+\gamma N)\,h} - \mu_{ij}\frac{1}{2}\tau_{ij}c_s\right]^2 \tag{20}$$

and

$$\pi_{s,iz} = \frac{(L_z + H_z + M_z)}{\beta}\left[\alpha\frac{\beta}{2\beta+\gamma N} + \frac{1}{2}\gamma c_s\frac{H_z + H_j\tau_{jz}}{(2\beta+\gamma N)\,h} - \mu_{iz}\frac{1}{2}\tau_{iz}c_s\right]^2 \tag{21}$$

Expressions (19), (20) and (21), together with the expression for $S[N_i, P_i]$ can be substituted into (12) to get w_r^H.

Making use of (16) and of the following expression

$$\int_{x\in N} p_x^2 dx = \left(\frac{\alpha\beta+\gamma P_i}{2\,(\beta+\gamma N_i)}\right)^2 N_i + \frac{1}{4}c_s^2\frac{H_i + H_j\tau_{ij}^2 + H_z\tau_{iz}^2}{h} + c_s\frac{\alpha\beta+\gamma P_i}{2\,(\beta+\gamma N_i)}\delta_i$$

we can rewrite $S[N_i, P_i]$ as follows

$$S[N_i,P_i] = \frac{1}{2}\alpha^2 N_i\frac{\beta+\gamma N_i}{(2\beta+\gamma N_i)^2} + \frac{1}{4}c\frac{2\alpha\beta+c\gamma\delta_i}{\beta\,(2\beta+\gamma N_i)} - \frac{1}{8}c\delta_i\,(4\beta+3\gamma N_i)\,\frac{4\alpha\beta+c\gamma\delta_i}{\beta\,(2\beta+\gamma N_i)^2} + \frac{1}{8\beta}c^2\frac{H_i + H_j\tau_{ij}^2 + H_z\tau_{iz}^2}{h}$$

which depends on τ_{ij} and on τ_{iz}, while it is not affected by τ_{jz}.

Turning our attention to the wage of skilled workers in i, numerical analysis show that w_i^H increases if τ_{ji} or τ_{zi} decrease. It is so because total firms' profits increase as a consequence of lower cost of intermediates $S[N_r, P_r]$ in (7). At first sight, this finding may appear in contradiction with *Proposition 2* or equation (20), in which τ_{zi} is shown to have no impact on π_{ij} , a positive impact on $\pi_{s,iz}$ and a negative impact on the more important domestic market $\pi_{s,ii}$. It is not so because it should be remembered that the expressions (19), (20) and (21) refer to operating profits, whereas skilled worker wages are paid from total profits, which benefit from the reduction in fixed costs engendered by cheaper intermediates even if such reduction in fixed costs is not passed through to selling prices. Considering that the unskilled workers are remunerated at the wage they could obtain by producing and selling the numéraire, the following proposition holds:

Proposition 5 (trade-liberalization-driven wage gap): a decrease in the trade barriers faced by country i is expected to increase the wage gap between skilled and unskilled workers in i .

2.4 Local and global welfare considerations

Finally, it is worth noting that the system of preferences expressed in (1) can also be used to draw the indirect utility functions capturing the welfare of consumers in the three countries considered:

$$W = \frac{\alpha^2 N}{2(\beta+\gamma N)} - \frac{\alpha}{\beta+\gamma N}\int_{s\in N} p_s ds + \frac{\int_{s\in N}(p_s)^2 ds}{2\beta} - \frac{\gamma}{2\beta(\beta+\gamma N)}\left[\int_{s\in N} p_s ds\right]^2 + w + \overline{q}_0, \tag{22}$$

from which it can be noted that[5]

$$\frac{\delta W^\zeta}{\delta p_s^\zeta} < 0 \quad ; \quad \frac{\delta W^\zeta}{\delta w^\zeta} > 0.$$

Combining this result with the impact on prices, from equations (13) and (16), and the impact on profits and skilled workers' wages, from equations (19), (20) and (21), we can affirm that the decreases in tariffs are expected to have a positive impact on the welfare of the consumers of the countries involved. Our results confirm Wonnacott's (1996) intuition that the benefits of trade creation are expected to more than offset the losses of welfare caused by trade diversion when PTAs or bilateral tariff reductions result in lower prices. In our model this outcome is driven by the fact that the price index will reflect the higher importance in the bundle of consumption of cheaper varieties imported from the PTA partners.

Turning to the country excluded from the PTA, it should be noticed that their price indices will not be affected by being excluded from a PTA. However, firms' profits and high skilled workers' salaries will be affected negatively from the fact that their exports will face a tougher competition in the markets involved in the PTA.

However, from (20) it can be noticed that the increase in export profits and high skilled workers' salaries in the integrating countries could be higher than the loss of export income in the excluded

[5]The sign of the first derivative is negative as this is consistent with a positive value of quantities in (3).

country. Therefore our model suggests that even a bilateral PTA could be associated with static global welfare gains.

3 Empirical strategy

In this section we present the empirical strategy we use to test the theoretical predictions (1) --(5) on trade and labor market outcomes. To this end we use a comprehensive dataset containing information on trade liberalization, trade flows, wage and employment by skill level. The first three propositions are addressed using an augmented gravity equation (Anderson and Van Wincoop 2003; Baier and Bergstrand 2007). Propositions 4 and 5 are tested using a standard wage premium methodology (Revenga 1997; Goldberg and Pavnik 2005).

3.1 Data

For our empirical analysis, we combine two main datasets, one on trade flows and the other on wage and employment by skill level. Trade data come from BACI (CEPII), which includes bilateral trade flows in values and quantities for a complete set of exporting and importing countries in the period 1989-2007 [6] - however our estimation sample starts in 1996 because of tariff data availability. Although BACI provides trade data at product level (classification HS-6 digit) we aggregated them at ISIC industry level in order to match it with labor market dataset. Labor market data come from EU KLEMs dataset reporting information on wage and employment level by education (primary, secondary and tertiary)[7] for a sample of OECD countries in the period 1970-2005.

Our main proxy for trade liberalization is based on the applied bilateral tariff level from TRAINS (here aggregated by simple averaging at ISIC level). However, we also use a Preferential Trade Agreement dummy (PTA) to capture the effect of trade liberalization. The PTA dummy variable is based on a comprehensive list of PTAs in force based on data available on the WTO website.

[6] The dataset includes observations up to 2010, but we use the trade only up to 2007 to get rid of the highly volatile observations during the recent crisis.

[7] In what follows we classify tertiary and secondary educated workers as "Skilled" and primary educated workers as "Unskilled" workers

Other variables come from standard sources: (i) geographic variables (such as distance) come from CEPII dataset[8]; (ii) GDP and population data for both exporting and importing countries are from the World Bank's World Development Indicators.

3.1.1 Trade related estimations

Our estimation strategy to test propositions (1) - (3) relies on the standard augmented gravity model (Anderson and van Wincoop 2003; Silva and Tenreyro 2006; Head and Mayer 2013). Highly disaggregated data from BACI allow us to estimate the trade creation (*Proposition 1*), diversion (*Proposition 3*) and export competitiveness effect (*Proposition 2*) at sector (ISIC) level for a set of 186 exporting and importing countries in the period 1996-2007. In particular we run the following regression:

$$y_{i,j,s,t} = \phi_{it} + \phi_{jt} + \phi_{st} + \beta_1 Tariff_{ijst} + \beta_2 PTA_{ijt} + \beta_3 X_{ij} + \varepsilon_{ijst} \tag{23}$$

where subscripts i,j,s and t stand respectively for exporter, importer, sector ISIC and year. Following the theoretical model presented in the previous section, our dependent variable $y_{i,j,s,t}$ is the exported quantity from country i to j at time t. However, as a robustness checks, we replicate our estimations also on export values.

The crucial explanatory variables capturing bilateral trade liberalization (as suggested in the theoretical model) are in turn: (i) the bilateral sector-specific applied tariff level in log ($Tariff_{ijst}$), and Preferential Trade Agreement dummy being equal to one if country i and j share a PTA at time t (PTA_{ijt}).

The vector of control variables X_{ij} includes geographic variables traditionally used in estimating structural gravity models to predict trade flows. Such control variables set includes: (i) distance (in ln), (ii) common border, (iii) language and (iv) past colonial linkages.

Finally, we include three sets of fixed effects to control for several country-year (ϕ_{it}, ϕ_{jt}) and sector-year specific factors affecting trade flows but not explicitly included in equation [23]. Country-year fixed effects capture country specific macroeconomic dynamics (such as GDP, population, etc.),

[8]Mayer and Zignago (2011).

but also for some variables deriving from the theoretical model, such as the number of producing firm in each country (M_v), the number of high (H_v) and low (L_v) skilled workers available in the country at time t. More importantly country-year fixed effects capture the multilateral resistance term as in Baier and Bergstrand (2007) and Head and Mayer (2013).[9] Sector-year fixed effects capture any potential technological shocks in a give sector, but also for the elasticity of substitution across varieties within sector s as in the theoretical model.

Although not explicitly included in the model, relative comparative advantage in a specific sector can affect export performances of firms in each country-sectors. For example French exporters may have a comparative advantage with respect to Germany in the food sector, while Germany may have a comparative advantage in the automotive sector with respect to France. To control for this effect, as robustness check, we augment specification in [23] by including country pair by sector fixed effects [DROP THIS SENTENCE IS RESULTS ARE NOT GOOD].

These are the variables needed to test *Proposition* 1. However, to test *Propositions* 2 and 3 we need two additional variables. *Proposition* 2 suggests that the bilateral reduction of trade cost between country i and j does not imply the increase of exports by i towards a third country z. To fit such proposition in the empirical framework proposed in (23), where the dependent variable is ij specific, we can also say that bilateral liberalization iz does not imply increase in bilateral trade between country i and j. On the other hand, *Proposition* 3 predicts the traditional trade diversion effect: the country excluded from the bilateral liberalization will face a reduction in its exports.

Thus we need one variable to capture changes in trade costs between the exporter i and the rest of the world; and another variable to capture changes in trade costs between the importer j and the rest of the world. In finding these variables we draw from the existing literature on trade diversion (see Gosh and Yamarik 2004; Baldwin and Jaimovich 2012). We use two dummy variables; the first being one if the exporter has at least a PTA with the rest of the world (to test *Proposition* 2); the second dummy has the same logic but from the perspective of the importer country (to test *Proposition* 3). The intuition is that each PTA with the rest of the world implies higher market

[9] We are aware that to proper control for multilateral resistance term in our setting we would need country-sector-time fixed effects, but unfortunately we have not enough time variation (period 1996-2007) in the applied tariff so we use only country-year to proxy for the multilateral resistance term.

access and lower trade costs vis-à-vis a third country.

Since these two measures are country-year specific, in the empirical specification we cannot include country-year fixed effect (because of perfect collinearity) which are replaced by country-period fixed effects (one period lasts three years)- $\phi_{i,p}$ and $\phi_{j,p}$ respectively. Sector-year fixed effects still included.

Thus, to test propositions 2 and 3 we rely on the following empirical model:

$$y_{i,j,s,t} = \phi_{i,p} + \phi_{j,p} + \phi_{s,t} + \beta_1 Tariff_{ijst} + +\beta_2 PTA_{ijt} + \beta_3 ExpDiv_{izt} + \beta_4 ImpDiv_{jzt} + \beta_5 X_{ijt} + \varepsilon_{ijst} \quad (24)$$

where $Tariff_{ijst}$ and PTA_{ijt} have the same meaning as in the previous specification (i.e. applied tariff level and PTA dummy). The new crucial variables in specification (24) are $ExpDiv_{izt}$ and $ImpDiv_{jzt}$; they are dummy variables equal to one if respectively exporter and importer country have a PTA in force with at least one third country (z). Since country-year fixed effects have to be dropped, the set of control variables X_{ijt} in equation (24) has been augmented to control for the multilateral resistance term (which, however, is partially captured by country-period fixed effects). We follow Wei (1996) and use "log GDP-weighted average distances", or $remoteness$, as a proxy for the multilateral price resistance term. In particular, we follow the definition of remoteness provided by Baldwin and Harrigan (2011) by taking the inverse of the Harris market potential.[10] The set of control variables includes also per capital GDP in both exporter and importer country.

The first econometric issue concerning equations (23) and (24) is the potential endogeneity due to both reversal causality and omitted variable problems. The omitted variable problem is crucially reduced by the inclusion of a huge set of fixed effects and control variables, which captures all the variables potentially affecting trade flows. But the simultaneity problem needs to be properly addressed. Indeed, on the one hand countries can sign a PTA to secure their current level of trade with an established trade partner (as in the case of the EU-US negotiations); on the other hand,

[10] $Remoteness_{it} = \left(\sum_j GDP_j / Dist_{ij}\right)^{-1}$

importer country j might increase tariff protection because of huge imports from i in a specific sector s. Thus, tariff level and PTA dummy are both potentially endogenous with respect to trade flows.

As a first step, we run a strict exogeneity test (Wooldridge 2002; Baier and Bergstrand 2007; Head and Ries 2010). Strict exogeneity test consists in testing whether any "feedback effects" emerges between potentially endogenous and dependent variables. In practice, we include the $future$ tariff level and PTA dummy in equation (23) and (24): if tariff changes and PTA's signature are strictly exogenous to trade flows, $future$ values of tariff and PTA dummy (lead values) should be uncorrelated with the concurrent trade flow. We cannot reject the null of strict exogeneity for all our specifications, with the exception of tariff level in the exported values regressions (see table 3).

However, to further reduce any residual concerns on simultaneity, we use an instrumental variable approach. To instrument the PTA dummy variable we build on the domino effect in PTAs formation identified by Baldwin and Jaimovich (2012) and Chen and Joshi (2010): we use the total number of PTAs signed respectively by exporter and importer country with the rest of the world. The idea is that the higher is the number of PTAs that country i and j have with the rest of the world, the higher will be the probability that the two countries sign a PTA together in order to avoid reciprocal trade diversion effect. These two variables are expected to be highly correlated with the PTA dummy and uncorrelated with ij specific trade flows. The exclusion restriction here is satisfied if having a high number of PTAs with the rest of the world does not affect (and is not affected by) bilateral trade flows. Our theoretical model and empirical results (see Table **??**) support such assumption from the perspective of the exporter country (bilateral liberalization does not imply export increase into a third country - *Proposition* 2). Thus, we use only the number of PTAs by exporter country as instrumental variable for bilateral PTA. [11] Since our instrument for PTA is exporter country-year specific we could not include exporter country-year fixed effects in our 2SLS approach; thus we rely on exporter country fixed effect along with importer country-year and sector-year fixed effects.

[11] Results hold even by using both the number of PTAs by exporter and importer

Finding a valid and relevant instrument for the tariff level is more complicated.[12] We use the average protection level applied by importer country j (in sector s) with respect to the rest of the world (all countries z but exporter i). This variable is highly correlated with the bilateral tariff level (see 2SLS first stage results in the following section) and mainly uncorrelated with bilateral trade flows. Indeed, there is not reason for country j to change tariff level with z when changes in imports from i are experienced (exclusion restriction).

The last econometric issue concerns the zero trade flows problem (Helpman et al. 2008; Silva and Tenreyro 2006); in presence of large number of zeros in bilateral (sector) specific trade flows in the dataset, the log specification implies the drop of these flows and the resulting OLS estimator is biased (i.e. systematic sample selection of data). As a first solution, in all our OLS estimations we use the log of trade flow plus one. However such solution is sensitive to the unit of measure and suffers the heteroskedasticity of the error terms. In our data trade data are expressed in euros and kilos, so adding one to the trade flows should not affect our estimation. However, the heteroskedasticity problem remain and we need further estimation procedure to have unbiased coefficients on tariff and PTA dummy.

Although there is not a perfect estimator in presence of high zero flows (see Head and Mayer 2013), according to the recent literature on gravity equation estimation we address the zero flows problem by using Poisson Pseudo Maximum Likelihood (PPML) estimator as proposed by Silva and Tenreyro (2006). Unfortunately non linear Poisson model, being in levels, over-weights big observations (Head and Mayer 2013), so we also run PPML estimation on both the complete dataset and on a sub-samples of trade flows below the 95^{th} percentiles. In the PPML estimator we include the same set of fixed effects we used in estimating the OLS model.

3.1.2 Labor market estimations

Propositions 4 and 5 suggest that a decrease in trade costs due to a reduction in protection by trading partners (or improved market access) implies a reduction in unskilled workers' employment

[12] Widely used instrument for tariff is the pre-liberalization tariff level (Goldberg and Pavnik 2015; Buono and Lalane 2012); however such instrument is specifically thought for country specific trade liberalization and does not show time variance. Since in our setting we use a panel of country and heavily rely on time variation we decided to abandon this instrument

and an increase in the wage gap between skilled and unskilled workers. [13]

In order to test these two propositions, we estimate the following simple reduced-form wage and employment equations using aggregated exporters-sector-year data:

$$ln(\frac{SkilledWage}{UnskilledWage})_{i,s,t} = \phi_i + \phi_{s,t} + \beta_1 Tariff_{i,s,t} + \beta_2 X_{i,s,t} + \varepsilon_{i,s,t} \tag{25}$$

and

$$ln(UnskilledEmployment)_{i,s,t} = \phi_i + \phi_{s,t} + \beta_1 Tariff_{i,s,t} + \beta_2 X_{i,s,t} + \varepsilon_{i,s,t} \tag{26}$$

where i, s and t denote respectively exporter country, sector ISIC and year. Our main explanatory variable is the log of average tariff level faced by each exporter in all his destination markets (sector specific average across all partner countries). We include exporter (ϕ_i) and sector-year ($\phi_{s,t}$) fixed effect to control for the exporter country and sector-year specific characteristics. Country fixed effects capture differences in labor market characteristics among countries (i.e. rigidities in labor market); while sector-year fixed effects capture sector specific shock common to all countries (i.e. technological and productivity shocks).

In order to control for country specific macroeconomic cycle, the set of control variables ($X_{i,s,t}$) includes the GDP and the population size by exporter country. It also contains the number of PTAs signed by each country to make sure that our tariff variable keeps the effect of a reduction in the variable cost of exporting and not simply a better market access (indeed, in the theoretical model tau represents the iceberg cost of trade). Then we follow Goldberg and Pavnik (2005) and extend the set of control variables by including the real exchange rate ($REER$) and the total amount of exports by exporter country ($Tot\ Export$). Indeed, there may be other channels through which trade affects wages. For example, the real exchange rate may affect wages through the increase/decrease of trade flows due to changes in competitiveness. The inclusion of real exchange rate variable controls for the previous potential channel. To the extend that trade determinants affect trade flows, the *total exports* variable captures the combined effect of all trade related channels other than trade

[13] Actually our theoretical model predicts the reduction of unskilled employment in the domestic segment of production. However we have no information on the allocation of labor to domestic vs foreign market within the firm; so we can only test this proposition only indirectly by looking at the total employment.

liberalization (tariffs) on relative wages.

Further, since the skilled-unskilled wage ratio (and the level of unskilled employment) could also be affected by the trade specialization (i.e. comparative advantage) of the exporter country, we further control for the sector specific market share (computed as sector specific over total exports by country). Finally, to avoid any country-year specific omitted variable problem, we include also country-year fixed effects (see columns 7 and 8 in the tables of results).

While the number of fixed effects and control variables included in the estimation crucially reduce the omitted variable problem, some concerns on the simultaneity of tariff level need to be addressed. Indeed, as highlighted by Goldberg and Pavnick (2005) simultaneity bias could go either way. If trade liberalization pushes more productive (or able) workers from liberalized to protected sectors, the coefficient on tariff level would be upward biased. But it may also happen that firms respond to trade liberalization by firing less productive (or able) workers, which would imply that the remaining workers represent a sample of more productive and better paid workers, which bias the tariff coefficient. In other words, tariff variable could capture the pure tariff liberalization effect and the indirect effect through the sample of workers (sample selection). To solve this problem we use an instrumental variable approach. As already noticed, finding a good instrument for tariff level is not easy. The average tariff level faced by each exporter in a given sector used as IV in the previous section cannot be used in the current framework since it is now exactly the variable of interest (the variable to be instrumented). Thus we follow the idea by Goldberg and Pavnik (2005), who argue that tariff reductions in each sector are proportional to the initial level (pre-tariff liberalization), and use the tariff level in the starting year as first instrumental variable.

However, the former instrument does vary over time, hence we use the three-year lagged tariff level to instrument the contemporaneous tariff level. The relevance of this last instrument is verified in the first stage results (see table 8, 13, 14); but, in case of time persistence of tariff level, the three year lags cannot be considered exogenous (validity problem), so we use a further set of instruments. We assume that country-sector specific tariff level could be approximated by: (i) the average sector-specific tariff level (average across importing countries) and (ii) the country-specific tariff level (average across sectors by importing country). This last set of instruments is

very correlated with the country-sector specific tariff level (see table 13, 14, 8) and can arguably be considered exogenous because it depends on tariff level in other countries and sectors than the country-sector pair being analyzed.

4 Main results

For expositional purposes, also in this section the results of the empirical tests presented in the previous sections are split into two groups: first, impacts on trade flows are analyzed (*Propositions* 1, 2, and 3), then we turn to the labor market outcomes (*Propositions* 4 and 5).

4.1 Trade flows

The empirical tests for our first three propositions can be found on Tables **??** to 5, where first are shown OLS regressions on traded quantities (Table **??**) and values (Table **??**), then follows a Poisson regression model on values and quantities (Table 2) and the strict exogeneity test on values and quantities (Table 3). Finally a 2SLS regression on values and quantities is displayed (Table 4 for the second stage of 2SLS approach and 5 for the first stage results).

As stated in *Proposition 1 (trade creation),* the consistently negative and significant coefficients on the tariff variable (or a consistently positive sign on the PTA dummy) in all the tables and specifications (with just a few cases of low statistical significance) signals that a decrease in trade barriers between country i and j is indeed associated with an increase in bilateral trade flows. Such evidence is robust across all the specifications and econometric models we used (OLS, Poisson and 2SLS).[14] According with our preferred specification OLS with country-year and sector-year fixed effect (column (6) in table 1) having a PTA in common stimulates bilateral trade by 28%; while a 10% tariff reduction implies a 1.2% increase in the bilateral trade flows.

As for *Proposition 2 (no improvement in export competitiveness)*, it can be noted that the variable "N. of PTAs by exporter with RoW" is associated with not significant coefficient (Table **??** columns 7 and 8) and a barely significant positive coefficient only in the OLS regression on values

[14]Table 5 suggests the relevance of our instruments in predicting both tariff level and PTA dummy. Indeed coefficients on IV for tariff and PTA are positive and strongly significant with safe F-stat for excluded instruments.

(Table **??**) - significant only at 10%. This is consistent with our model in which trade flows towards third countries are not expected to increase in the short run because vertical linkages are assumed to affect fixed costs but not variable costs of production (and thus the profit maximizing pricing strategy is unchanged).

Finally, *Proposition 3 (trade diversion)* states that a decrease in trade barriers between importer j and a third country z is associated with a decrease in the exports of i to j. The negative coefficients associated with the variable "N. of PTAs by importer with RoW" in Tables **??** and **??** confirm this prediction. As a robustness check we test *Proposition 3* also with Poisson model. Results shown in Table 2 columns (4) and (6) confirm our hypothesis.

4.2 Labor outcomes

To test *Proposition 4 (employment loss on the domestic segment),* Tables 6, 7 and 8 have to be read in combination with the Tables **??** to 5 presented above. In particular, Table 6 shows the results for a OLS regressions on the level of employment of unskilled workers in the different sectors; Tables 7 and 8 show respectively the second and the first step of the corresponding 2SLS regression.[15]

Since we have no information on the allocation of labor to different geographic segments within firms, we can only test our hypothesis indirectly, by looking at total employment (for the domestic and export segments) and exports. Assuming that the employment of unskilled workers is proportional to production, we can then indirectly capture the effect of a reduction in trade barriers on employment on the domestic segment. Indeed, whereas our results in Tables **??** to 5 state that a reduction in bilateral trade costs boosts trade and thus increases employment in the export segment, the coefficients in Tables 6 and 7 on the effect on total unskilled employment of a reduction in the average trade barriers vis-à-vis the rest of the world is positive and statistically significant, meaning that a reduction in trade barriers reduces the number of unskilled workers employed in the sector. The combination of these two results can hence be interpreted as an indirect indication

[15]First stage regression results show the relevance of our instrumental variables. Initial tariff level and the three year lag of tariff are good proxies for the current tariff level. Similarly the average tariff level by country and product are good predictors for the current tariff level; moreover in this last case, since we have an overidentified model, we can also conclude on the exogeneity of the instruments. According with the Sargan test the validity assumption is satisfied. The same arguments apply for 2SLS estimations on wage gap and skilled wage in tables 13 and 14

of the validity of *Proposition 4*. In more general terms, our model does not yield a clear results a priori on whether the additional employment generated by trade creation in equation (18) is enough to compensate for the loss of employment on the domestic market visible in equation (17) in the case of an equal bilateral reduction in trade barriers. The overall impact depends on the relative importance of barriers to entry and differentiation between varieties.

As for the impact on skilled workers' wages analyzed in *Proposition 5 (trade-liberalization-driven wage gap)*, our model yields much starker results. The increase in total profits due to cheaper imports in a framework characterized by vertical linkages implies that skilled workers can bid up their salary and increase the ratio between their earnings and the unskilled workers' earnings. Tables 9 to 14 confirm this prediction, which is robust to a wide set of controls and different estimation strategies. In fact, we test the trade-liberalization-driven wage gap in two slightly different ways. First, since the unskilled workers' wage is equal to the value of the numéraire in the model, we look at the ratio between skilled wages and unskilled wage. Then, for additional robustness, instead of the ratio we consider the level of skilled workers' earnings controlling for unskilled workers' earnings.

Specifically, first OLS regressions are run on the skill premium as the ratio between skilled and unskilled wages (Table 9)[16] and on the level of skilled workers' wages using unskilled workers' wages as a control (Table 10). Then the same dependent variables are regressed using instrumental variables in a 2SLS: Tables 11 and 13 show, respectively, the second and first stage of the 2SLS estimation on the ratio of skilled workers' wages over unskilled workers' wages. Tables 12 and 14 show, respectively, the last and first stage of the 2SLS on the level of skilled workers' wages using unskilled workers' wages as a control.

The two sets of regressions run with the two slightly different dependent yield qualitatively identical results and do not reject the *Proposition* 5: as the trade barriers decrease, the skill premium rises. This result holds statistically significant for a large number of different specifications, with few exceptions.

[16]Remember we defined as "skilled" the secondary and tertiary educated workers, while we refer as "unskilled" to primary educated workers

Summing up, none of the theoretical propositions of the model seems to be strongly rejected from the data, which suggests that the model presented may represent a reasonable framework to study the interactions between vertical linkages and labor markets in a context of reduction of trade protection.

5 Conclusions

In this paper we analyzed the impact of bilateral tariff reductions and PTAs not only on the involved parties but also on third countries. We did so by using a three-country monopolistic competition model with vertical linkages and a labor market differentiated by skill level. Empirical tests of our analytical results seem to confirm that:

- bilateral trade liberalization increases trade flows between the countries involved in the integration process;

- the countries involved in the integration process do not gain a competitive advantage in exporting to third countries;

- the countries involved in the integration process divert trade away from third countries by importing less of their products;

- among the countries involved in the integration process, unskilled workers' employment levels decrease on the lines of production serving the domestic market and increase in the lines of production serving the export segment. Theoretically, the overall effect is not a priori determined but depends on the relative importance of entry barriers and product differentiation. Empirically, we observe a decline in unskilled workers' employment following trade liberalization.);

- the skill-driven wage gap within the countries involved in the integration process increase, i.e. the difference in remuneration between skilled and unskilled workers rises.

In addition, as long as the prices in the integrating countries fall, because of the reduction in trade costs, and the wages increase, the tariff reduction of PTA can be shown to be locally welfare improving for the participants of the agreements and is likely to be globally welfare improving since the only loss in the third countries stem from the reduction in their income from exports, which is

shifted to producers of the integrating countries.

These results all hold in the short run, or as long as the number and location of firms and workers is held fix. As usual, there is no reason to expect that the long-run analysis would yield the same outcomes. For example, in the long run it is likely that the additional entry due to the cost savings associated with trade liberalization cause an increase in exports to third countries. Still, the focus on the short run allowed us to obtain clear predictions to test empirically and keep a tight connection between the theory and the empirics. A promising future avenue of research would then be to investigate whether our results are robust to an extension of the model with endogenous entry and exit of firms and/or migration patterns, even if the empirical validation of such an extension would not constitute a trivial pursuit.

Tables

Table 1: Trade liberalization and exported quantities - OLS

	Exported Quantities in Ln				Exported Values in Ln			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln(Tariff+1)	-0.109***		-0.112***	-0.120***	-0.074***		-0.076***	-0.072***
	(0.014)		(0.014)	(0.014)	(0.013)		(0.013)	(0.012)
PTA dummy		0.244***	0.248***	0.224***		0.126***	0.129***	0.114***
		(0.023)	(0.023)	(0.021)		(0.020)	(0.020)	(0.018)
Distance (ln)	-1.934***	-1.946***	-1.945***	-1.945***	-1.689***	-1.695***	-1.695***	-1.690***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.013)	(0.013)	(0.013)	(0.013)
Colony	0.583***	0.610***	0.609***	0.597***	0.665***	0.679***	0.678***	0.660***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.021)	(0.022)	(0.022)	(0.022)
Common Language	0.602***	0.606***	0.605***	0.613***	0.669***	0.671***	0.670***	0.689***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)
Contiguity	0.259***	0.255***	0.255***	0.294***	0.250***	0.248***	0.248***	0.292***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.021)	(0.021)	(0.021)	(0.021)
Dummy if exporter has PTA with RoW				-0.091				0.371*
				(0.235)				(0.020)
Dummy if importer has PTA with RoW				-0.205**				-0.164*
				(0.095)				(0.089)
Fixed Effects								
Sector	yes	yes	yes	yes	yes	yes	yes	yes
Country-Year	yes	yes	yes	no	yes	yes	yes	no
Country-period	no	no	no	yes	no	no	no	yes
Sector-Year	yes	yes	yes	yes	yes	yes	yes	yes
Country-Year Controls (pc GDP, remoteness)	no	no	no	yes	no	no	no	yes
Observations	151939	151939	151939	149563	160183	160183	157595	160183
R-squared	0.748	0.748	0.748	0.749	0.779	0.779	0.781	0.779

Country-Year control variables included in specifications (4) and (8) are: per capita GDP and REMOTENESS for both exporter and importer country
Robust standard errors in parentheses. *** $p < 0,01; **p < 0,05; *p < 0,1$.

Table 2: Trade liberalization and exports (values and quantities) - Poisson

	Exported Values				Exported Quantities			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln(Tariff +1)	-0.714	-0.0472***	-0.244***	-0.0449***	-0.211**	-0.134***	-0.147*	-0.120***
	(0.764)	(0.0145)	(0.0810)	(0.0140)	(0.0963)	(0.0120)	(0.0828)	(0.0113)
PTA dummy	1.332	0.119***	1.482***	0.105***	0.402***	0.0594***	0.247	0.0605***
	(4.500)	(0.0233)	(0.219)	(0.0215)	(0.108)	(0.0184)	(0.520)	(0.0170)
Distance (ln)	-2.712	-1.208***	-2.716***	-1.199***	-1.311***	-1.005***	-1.296***	-0.984***
	(10.19)	(0.0131)	(0.154)	(0.0133)	(0.100)	(0.0108)	(0.133)	(0.0108)
Colony	-1.437	0.229***	-0.346***	0.234***	0.263***	0.300***	0.263***	0.312***
	(4.262)	(0.0221)	(0.0743)	(0.0222)	(0.0380)	(0.0172)	(0.0574)	(0.0171)
Common Language	-1.075	0.297***	-0.661***	0.300***	0.477***	0.306***	0.298***	0.312***
	(3.126)	(0.0116)	(0.102)	(0.0116)	(0.0358)	(0.00929)	(0.0380)	(0.00931)
Contiguity	3.329	0.170***	1.078***	0.179***	0.00705	0.150***	-0.258***	0.161***
	(4.642)	(0.0189)	(0.0790)	(0.0190)	(0.0492)	(0.0154)	(0.100)	(0.0154)
Dummy if importer has one PTA with RoW			-1.125	-0.349***			0.100	-0.113
			(1.344)	(0.118)			(0.600)	(0.0787)
Country-Year FE	yes	yes	no	no	yes	yes	no	no
Sector-Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Country-Year Controls	no	no	yes	yes	no	no	yes	yes
Sample	All	less 95%	All	less 95%	All	less 95%	All	less 95%
Observations	151939	141163	149563	138792	160183	148551	157595	145964

Country-Year control variables in (3) (4) (7) (8) include: per capita GDP and REMOTENESS for both exporter and importer country
Robust standard errors in parentheses. All specifications include country-period and sector fixed effects *** $p < 0,01; **p < 0,05; *p < 0,1$.

Table 3: Trade liberalization and exports (values and quantities) - Strict Exogeneity Test

	Exported Values in Ln		Exported Quantities in Ln	
Ln(Tariff+1)	-0.021	-0.021	-0.119***	-0.119***
	(0.019)	(0.019)	(0.021)	(0.021)
PTA dummy	0.123***	0.127***	0.204***	0.216***
	(0.025)	(0.025)	(0.028)	(0.029)
Ln(Tariff+1)t+2	-0.064***	-0.064***	0.010	0.010
	(0.019)	(0.019)	(0.021)	(0.021)
PTA dummy t+2	-0.020	-0.023	0.038	0.029
	(0.031)	(0.031)	(0.035)	(0.035)
Distance (ln)	-1.677***	-1.677***	-1.952***	-1.953***
	(0.014)	(0.014)	(0.016)	(0.016)
Colony	0.243***	0.243***	0.253***	0.253***
	(0.022)	(0.022)	(0.025)	(0.025)
Common Language	0.626***	0.626***	0.527***	0.527***
	(0.0245)	(0.024)	(0.027)	(0.027)
Contiguity	0.676***	0.676***	0.612***	0.612***
	(0.0128)	(0.012)	(0.014)	(0.014)
Dummy if exporter has PTA with RoW		0.134		-0.255
		(0.272)		(0.239)
Dummy if importer has PTA with RoW		-0.089		-0.276**
		(0.103)		(0.112)
Observations	123967	123967	118479	118479
R-squared	0.775	0.775	0.747	0.747

Country-period and sector-year fixed effects included

Robust standard errors in parentheses. *** $p < 0,01; * * p < 0,05; * p < 0,1$.

Table 4: Trade liberalization and exports (values and quantities) - 2SLS Second Stage Regressions

	Exported Values in Ln			Exported Quantities in Ln		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Tariff+1)	-0.185***		-0.185***	-0.233***		-0.233***
	(0.018)		(0.018)	(0.019)		(0.019)
PTA dummy		0.171*	0.166*		0.496***	0.478***
		(0.0998)	(0.0997)		(0.108)	(0.108)
Distance (ln)	-1.699***	-1.703***	-1.706***	-1.943***	-1.958***	-1.962***
	(0.013)	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
Colony	0.653***	0.674***	0.670***	0.575***	0.628***	0.625***
	(0.021)	(0.024)	(0.024)	(0.024)	(0.026)	(0.026)
Common Language	0.666***	0.668***	0.667***	0.602***	0.610***	0.609***
	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.012)
Contiguity	0.238***	0.241***	0.236***	0.251***	0.248***	0.246***
	(0.020)	(0.020)	(0.020)	(0.022)	(0.022)	(0.022)
Observations	153370	160183	153370	145445	151939	145445
R-squared	0.777	0.778	0.777	0.749	0.747	0.749

Exporter, Importer-year, sector-year fixed effects included

Robust standard errors in parentheses. *** $p < 0,01; * * p < 0,05; * p < 0,1$.

Table 5: Trade liberalization and exports (values and quantities) - 2SLS First Stage Regressions

	Exports in values				Exports in quantities			
	Ln(tariff+1)	PTA	Ln(tariff+1)	PTA	Ln(tariff+1)	PTA	Ln(tariff+1)	PTA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IV Tariff (in ln)	0.867***		0.867***	-0.000	0.867***		0.867***	-0.000
	(0.005)		(0.005)	(0.001)	(0.005)		(0.005)	(0.001)
N. of PTAs exporter country		0.020***	-0.001**	0.020***		0.020***	-0.001**	0.020***
		(0.000)	(0.000)	(0.001)		(0.000)	(0.000)	(0.000)
Observations	153370	160183	153370	153370	145445	151939	145445	145445
Shea Rsquared	0.533	0.038	0.533	0.038	0.533	0.040	0.533	0.041
Fstat excl.Instru.	27085	6230	13542	3112	21999	6319	10999	3156

Exporter, Importer-year, sector-year fixed effects included.

Robust standard errors in parentheses. *** $p < 0,01; * * p < 0,05; *p < 0,1$.

Table 6: Unskilled workers regression. Trade liberalization and the employment of unskilled workers - OLS

	Log of (unskilled workers)									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ln(tariff+1)	0.161***	0.165***	0.188***	0.174***	0.206***	0.209***	0.208***	0.233***	0.290***	0.386***
	(0.032)	(0.039)	(0.038)	(0.041)	(0.040)	(0.040)	(0.046)	(0.048)	(0.044)	(0.061)
GDP (ln)			0.461*	0.456	0.421				0.465	
			(0.260)	(0.291)	(0.290)				(0.290)	
Population (ln)			2.895***	3.359***	3.380***				3.402***	
			(0.553)	(0.614)	(0.612)				(0.650)	
N. of PTAs				-0.075	0.105	0.106			0.071	
				(0.0845)	(0.094)	(0.095)			(0.098)	
REER (Ln)				0.114**	0.103*	0.103*			0.118**	
				(0.050)	(0.054)	(0.053)			(0.057)	
Tot Export (Ln)				-0.009	-0.011				-0.010	
				(0.029)	(0.029)				(0.030)	
Sector Specialization						0.028***		0.029***		0.041***
						(0.008)		(0.009)		(0.011)
Fixed Effects:										
Country	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Sector	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Sector-Year	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country- Year	no	no	no	no	no	no	yes	yes	no	yes
Sample:	complete	complete	complete	complete	complete	complete	complete	complete	No Oil and metals	No Oil and metals
Observations	1379	1379	1379	1319	1319	1319	1379	1319	1100	1100
R-squared	0.931	0.933	0.935	0.931	0.934	0.935	0.942	0.941	0.941	0.949

Robust standard errors in parentheses. *** $p < 0,01; * * p < 0,05; * p < 0,1$.

Table 7: Trade liberalization and the employment of unskilled workers - 2SLS

	Log of (unskilled workers)					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(tariff+1)	0.316***	0.339***	0.144***	0.250***	0.528***	0.793***
	(0.120)	(0.117)	(0.048)	(0.057)	(0.148)	(0.161)
GDP (ln)		0.033		0.414*		0.179
		(0.470)		(0.240)		(0.311)
Population (ln)		3.605***		3.332***		4.795***
		(0.740)		(0.496)		(0.717)
N. of PTAs		0.055		0.113*		0.178**
		(0.079)		(0.063)		(0.074)
Sector Specialization		0.023***		0.027***		0.026***
		(0.008)		(0.007)		(0.007)
REER (Ln)		0.150***		0.097**		0.140***
		(0.050)		(0.043)		(0.053)
Fixed Effects:						
Country	yes	yes	yes	yes	yes	yes
Sector	yes	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes	yes
Observations	965	923	1379	1319	1241	1187
R-squared	0.933	0.933	0.931	0.933	0.926	0.918

Table 8: Trade liberalization and the employment of unskilled workers - First stage 2SLS

	Log of (tariff+1)					
Ln(tariff+1)t-3	0.299***	0.319***				
	(0.048)	(0.053)				
Average Tariff by County			0.657***	0.627***		
			(0.035)	(0.038)		
Average Tariff by Product			0.512***	0.504***		
			(0.124)	(0.124)		
Ln(tariff+1) t=0					0.323***	0.354***
					(0.034)	(0.038)
Controls	no	yes	no	yes	no	yes
Fixed Effects:						
Country	yes	yes	yes	yes	yes	yes
Sector	yes	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes	yes
Observations	965	923	1379	1319	1241	1187
Shea R-squared	0.117	0.12	0.327	0.275	0.067	0.073
Fstat exclu.instr.	38.39	35.11	177	140	86.09	85.69
Sargan Test	-	-	0.35	0.891	-	-

Table 9: Skill premium regression. Trade liberalization and the wage of skilled/unskilled workers - OLS

	Log of (skilled wage/unskilled wage)									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ln(tariff+1)	-0.203***	-0.233***	-0.248***	-0.241***	-0.266***	-0.276***	-0.320***	-0.370***	-0.337***	-0.505***
	(0.047)	(0.054)	(0.054)	(0.057)	(0.057)	(0.058)	(0.063)	(0.068)	(0.068)	(0.089)
GDP (ln)			-0.077		-0.060	0.026			0.023	
			(0.334)		(0.369)	(0.374)			(0.378)	
Population (ln)			-1.625**		-2.369***	-2.448***			-2.347***	
			(0.755)		(0.816)	(0.812)			(0.881)	
N. of PTAs				-0.115	-0.214*	-0.213*			-0.181	
				(0.105)	(0.117)	(0.116)			(0.122)	
REER (Ln)				-0.101	-0.106	-0.111			-0.124	
				(0.068)	(0.072)	(0.073)			(0.078)	
Tot Export (Ln)				0.0321	0.0321				0.0241	
				(0.039)	(0.039)				(0.041)	
Sector Specialization						-0.057***		-0.060***		-0.070***
						(0.012)		(0.013)		(0.015)
Fixed Effects:										
Country	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Sector	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Sector-Year	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country- Year	no	no	no	no	no	no	yes	yes	no	yes
Sample:	complete	complete	complete	complete	complete	complete	complete	complete	No Oil and metals	No Oil and metals
Observations	1309	1309	1309	1249	1249	1249	1309	1249	1046	1046
R-squared	0.943	0.946	0.946	0.943	0.944	0.945	0.953	0.952	0.945	0.954

Robust standard errors in parentheses. *** $p < 0,01$; ** $p < 0,05$; * $p < 0,1$.

Table 10: Skill premium regression. Trade liberalization and the wage of skilled workers - OLS

	Log of (skilled wage)									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ln(tariff+1)	-0.045***	-0.045***	-0.038**	-0.037**	-0.034*	-0.038**	-0.033	-0.039*	-0.044**	-0.049*
	(0.013)	(0.017)	(0.017)	(0.018)	(0.018)	(0.018)	(0.021)	(0.023)	(0.020)	(0.026)
GDP (ln)			-0.418***		-0.285**	-0.264**			-0.261**	
			(0.109)		(0.125)	(0.126)			(0.125)	
Population (ln)			0.062		0.038	0.006			0.009	
			(0.243)		(0.262)	(0.260)			(0.273)	
N. of PTAs				0.065**	0.032	0.031			0.039	
				(0.029)	(0.034)	(0.033)			(0.032)	
REER (Ln)				-0.047**	-0.030	-0.032			-0.035	
				(0.022)	(0.024)	(0.024)			(0.025)	
Tot Export (Ln)				0.006	0.007				0.005	
				(0.009)	(0.009)				(0.009	
Sector Specialization						-0.013***		-0.013***		-0.010***
						(0.003)		(0.003)		(0.004)
Unskilled wage (ln)	0.063***	0.066***	0.065***	0.066***	0.066***	0.071***	0.075***	0.081***	0.067***	0.081***
	(0.0114)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)	(0.013)	(0.010)	(0.012)
Fixed Effects:										
Country	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Sector	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Sector-Year	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country- Year	no	no	no	no	no	no	yes	yes	no	yes
Sample:	complete	complete	complete	complete	complete	complete	complete	complete	No Oil and metals	No Oil and metals
Observations	1309	1309	1309	1249	1249	1249	1309	1249	1046	1046
R-squared	0.919	0.922	0.924	0.925	0.926	0.927	0.935	0.935	0.924	0.933

Robust standard errors in parentheses. *** $p < 0,01$; ** $p < 0,05$; *$p < 0,1$.

Table 11: Trade liberalization and the wage of skilled/unskilled workers - 2SLS

	Log of (skilled wage/unskilled wage)					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(tariff+1)	-0.350*	-0.402**	-0.116	-0.217**	-0.556***	-0.929***
	(0.195)	(0.186)	(0.076)	(0.090)	(0.178)	(0.198)
GDP (ln)		0.389		0.065		0.349
		(0.573)		(0.317)		(0.408)
Population (ln)		-2.842***		-2.300***		-3.879***
		(1.025)		(0.694)		(0.890)
N. of PTAs		-0.171*		-0.237***		-0.308***
		(0.099)		(0.082)		(0.093)
Sector Specialization		-0.046***		-0.051***		-0.054***
		(0.011)		(0.010)		(0.010)
REER (Ln)		-0.164**		-0.078		-0.137*
		(0.071)		(0.062)		(0.071)
Fixed Effects:						
Country	yes	yes	yes	yes	yes	yes
Sector	yes	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes	yes
Observations	918	876	1309	1249	1179	1125
R-squared	0.943	0.943	0.943	0.943	0.941	0.934

Robust standard errors in parentheses. *** $p < 0,01; * * p < 0,05; *p < 0,1$.

Table 12: Trade liberalization and the wage of skilled workers - 2SLS

	Log of (tariff+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(tariff+1)	-0.116*	-0.045	-0.079***	-0.061**	-0.166***	-0.220***
	(0.060)	(0.059)	(0.022)	(0.027)	(0.061)	(0.066)
GDP (ln)		-0.210		-0.225**		-0.152
		(0.195)		(0.106)		(0.134)
Population (ln)		-0.170		-0.010		-0.481
		(0.344)		(0.215)		(0.302)
N. of PTAs		0.047		0.031		0.013
		(0.029)		(0.024)		(0.029)
Sector Specialization		-0.013***		-0.012***		-0.014***
		(0.002)		(0.002)		(0.002)
REER (Ln)		-0.051**		-0.031		-0.051**
		(0.021)		(0.019)		(0.021)
Unkilled wage (ln)	0.074***	0.072***	0.065***	0.068***	0.073***	0.083***
	(0.013)	(0.014)	(0.011)	(0.011)	(0.013)	(0.014)
Fixed Effects:						
Country	yes	yes	yes	yes	yes	yes
Sector	yes	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes	yes
Observations	918	876	1309	1249	1179	1125
R-squared	0.919	0.925	0.918	0.923	0.914	0.913

Robust standard errors in parentheses. *** $p < 0,01; * * p < 0,05; *p < 0,1$.

Table 13: Trade liberalization and the wage of skilled/skilled workers - First stage 2SLS

	Log of (skilled wage)					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(tariff+1)t-3	0.285***	0.311***				
	(0.052)	(0.058)				
Average Tariff by County			0.672***	0.651***		
			(0.041)	(0.043)		
Average Tariff by Product			0.501***	0.494***		
			(0.124)	(0.125)		
Ln(tariff+1) t=0					0.326***	0.357***
					(0.035)	(0.028)
Controls	no	yes	no	yes	no	yes
Fixed Effects:						
Country	yes	yes	yes	yes	yes	yes
Sector	yes	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes	yes
Observations	918	876	1309	1249	1179	1125
Shea R-squared	0.103	0.112	0.312	0.265	0.071	0.077
Fstat exclu.instr.	29.57	28.23	137	118	85.12	84.56
Sargan Test	-	-	0.474	0.767	-	-

Robust standard errors in parentheses. *** $p < 0,01; * * p < 0,05; * p < 0,1$.

Table 14: Trade liberalization and the wage of skilled workers - First stage 2SLS

	Log of (tariff+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(tariff+1)t-3	0.280***	0.302***				
	(0.052)	(0.057)				
Average Tariff by County			0.672***	0.644***		
			(0.041)	(0.043)		
Average Tariff by Product			0.494***	0.486***		
			(0.125)	(0.126)		
Ln(tariff+1) t=0					0.319***	0.339***
					(0.035)	(0.039)
Controls	no	yes	no	yes	no	yes
Fixed Effects:						
Country	yes	yes	yes	yes	yes	yes
Sector	yes	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes	yes
Observations	918	876	1309	1249	1179	1125
Shea R-squared	0.101	0.108	0.313	0.264	0.068	0.069
Fstat exclu.instr.	29.07	27.58	137	116	81.99	73.85
Sargan Test	-	-	0.888	0.912	-	-

Robust standard errors in parentheses. *** $p < 0,01; * * p < 0,05; * p < 0,1$.

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